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USE OF MARKED INSECTS TO DEMONSTRATE MULTIPLE MATING IN *EFFERIA FREWINGI* (DIPTERA: ASILIDAE)[1]

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Abstract.—Using marked males and females of *Efferia frewingi* (Wilcox), it was demonstrated that multiple mating occurs. Ten males and eight females mated twice, and three males and one female mated three times. Mating times ranged from 6 to 24 minutes with a mean of 14.1 minutes.

Scattered references on multiple mating among asilids were recently summarized by Bullington and Lavigne (1980). Based on these limited data, we hypothesized that males of a non-courting asilid species would mate repeatedly with any female which they encountered, and that females would be equally receptive.

In order to successfully conduct a multiple mating study, a species with certain characteristics must be chosen: (1) Relatively high density so that there is a reasonable chance of the specimen mating with another of the same species while the investigators are present; (2) the length of time spent in copulo is short enough so that the complete matings of several individual pairs can be observed within a limited time period; and (3) the behavior of specimens is not affected by the marking material.

These criteria were met by a population of *Efferia frewingi* (Wilcox) located on open rangland one mile east of Laramie, Wyoming. We established that the density of the asilids was such that we could locate specimens within a reasonable time period. The ratio of females to males in several population samples was 2:1. Several mated pairs were kept under observation to establish the mating sequence. We observed that the behavioral sequence

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was essentially the same as reported for this species by Lavigne and Dennis (1975) from an open rangeland site near Shoshoni, Wyoming, 247 miles to the west.

Initially, mated pairs were located as we walked across the 2½ acre open rangeland site, but so few pairs were encountered that a second method was used. In this latter method, we netted a female asilid. Upon encountering a male asilid, we released the captive asilid near (e.g. 30 cm) the located specimen. In about 50% of the cases, the male flew rapidly after the female, making contact with her. Either copulation ensued during the "attack" flight (92%), or the female escaped from the male (8%). Escape was accomplished by the female fighting off the male or by the female exhibiting thanotosis (feigning death) and being dropped by the male.

After the mated pair rested on the ground from 4 to 18 minutes (mean 7.8 minutes), they flew onto vegetation at heights ranging from 25 cm to 3 m. Following the final extended buzz indicating imminent separation, the male fell off to the side, climbed back on, and then pulled away from the female using both legs and wings to initiate separation. As the pair was separating they were captured in a 15" insect net. This was sometimes accomplished by sweeping the pair off the vegetation. A simpler method was employed later that involved the placing of the net over the pair and the vegetation after the male had initiated the final wing buzz, as described by Lavigne and Dennis (1975).

Once captured, both sexes were marked by placing a dot of Testors model airplane paint (Pla Enamel, 1103 Red, The Testor Corporation, Rockford, Illinois), on the dorsal mesonotal bristles using the base of a grass stalk. When a previously mated individual was found mating again, another dot was added anteriorly in the same region. Subsequent observations of marked individuals showed that the presence of a spot of paint on the dorsum of the thorax did not interfere with normal activities of the asilid: Feeding, mating and oviposition.

Asilids were located and marked for 10 days during the experimental period, August 28 to September 14, 1979. A day of rain on September 13th, followed by freezing overnight temperatures caused a dramatic reduction in population size, resulting in the cessation of the experiment.

The majority of matings occurred between 1000 and 1300 hours, thus limiting the amount of time we could gather data.

In the initial stages of the experiment, at the termination of mating, all pairs were marked. Subsequently, searches were made for marked individuals, so that both marked and unmarked specimens could be released near each other.

The results of the marking experiment are as follows: (1) 31 males and 36 females were marked at least once; (2) 10 males and 8 females mated twice; and (3) 3 males and 1 female mated 3 times. These data support the hy-

pothesis that in a non-courting asilid species both males and females mate repeatedly, as observed incidentally by Lavigne and Dennis (1975).

In the course of the investigation, we noted that two of the mated females had prey when accosted by males, which was not observed by Lavigne and Dennis (1975). Additionally, one male, when presented with a female, took her as prey instead of as a mate. Based upon 29 complete matings, time spent in copulo ranged from 6 to 24 minutes with a mean of 14.1 minutes. These times closely correlate with those recorded by Lavigne and Dennis (1975).

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